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Critical length measurements for dry snow slab shear fracture

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Dry snow slab avalanches initiate from shear fracture in a thin weak layer underneath a planar slab of cohesive snow. In this paper, field data from more than 500 snow shear fracture tests are analyzed and applied to the problem of snow slab release and snow pack instability evaluation. The paper contains a detailed analysis using a simple, analytical model to estimate the critical length for shear fracture. The model contains the assumption of a finite fracture process zone which may be a significant fraction of the slab depth D or the critical length L for weak layer shear fracture. The field results show that the ratio L/D varies from about 0.1 to just over 2 and the model results vary within the same range. The analysis also shows that both the field and the model results for the ratio L/D follow a Gumbel probability density function. Since the experimental field data contain viscoelastic and slope normal effects, it is imperative to account for these in the model and for snow slab instability evaluation. Detailed evaluations considering both these effects are given in the paper.